REMARKS/ARGUMENT

Applicant responds herein to the Office Action dated February 12, 2003. A Petition for Extension of Time (one month) and the fee therefor are enclosed.

The various rejections and objections under 35 U.S.C. §112, first and second paragraphs, are noted. It is believed and respectfully submitted that the amendments to the claims herein avoid all of the noted grounds of rejections/objections. Accordingly, the Examiner is respectfully requested to reconsider and rescind the §112 rejections and objections.

Substantively, claims 1-7 and 8 stand rejected on grounds of obviousness over Danforth (5,997,795) in view of Clough (5,756,207). Claims 1-7 and 9 stand rejected on grounds of obviousness over the aforementioned references, further in view of either one of Radford (5,457,598) and Butler (5,137,634). Reconsideration is requested in view of the following remarks.

In accordance with the inventions in the applications, a highly advantageous method for fabricating a high density ceramic thick film is obtained. Significantly, a sol is applied to the surface of the film so that the sol infiltrates into the film whereby, during a subsequent sintering in a range of temperature that does not exceed 900°C, one obtains a product in which the piezoelectrical coefficient of the ceramic film is substantially increased.

The Examiner has applied Danforth, et al. (5,997,795) as the primary reference. Danforth teaches to use solid freeform fabrication techniques, to form bulk ceramic bodies comprising photonic bandgap structures. In the process of Danforth, solid particulate materials are mixed with a binder and, through a computer controlled process, are built up layer by layer, to form the structure. Additionally, through indirect methods, unfilled polymeric materials are built layer by layer to form a negative mold for the photonic bandgap structure. The cavities within the mold may then be filled with a slurry incorporating solid particulate materials.

One aspect of the present invention is that it utilizes screen printing. Nonetheless, the Examiner insists that, although Danforth does not disclose this process, it would have been obvious to one skilled in the art to mold the paste of Danforth by screen printing.

Regardless, Danforth does not show or suggest utilizing sol infiltration for densification. Rather, it only teaches metal, polymeric or ceramic solution infiltration. Still further, particularly as amended herein, the instant claims teach and specify a sintering temperature which falls within the range of 750-900°C. In other words, the present invention attains a process that produces a

ceramic thick film at the relatively low temperatures of under 900°C. The cited reference does not teach the claimed process.

It is noted that if a ceramic thick film on a substrate is sintered at a too high temperature, the film and the substrate are reacted rapidly at the interface therebetween. This reaction decreases the electrical properties of the film. As can be appreciated from the attached Figure 1, the reaction between PZT and Si substrate at over 900°C produces an unfavorable effect. Thus, it is preferred to fabricate a ceramic thick film at lower temperatures. But from another consideration point, desired properties such as piezoelectric coefficients of a ceramic thick film, cannot be attained or obtained through low temperature sintering.

It is only through the process of the present invention which teaches sol infiltration into the ceramic thick film that one attains good properties enabling producing quality product at temperatures below 900°C. This can be observed in the attached Figure 2. That Figure shows that the piezoelectric coefficient of a ceramic is increased about twice as high after sol infiltration.

In response to the Office Action, the applicant does not contend that the primary reference is limited to what <u>its claims</u> recite. Of course, the specification itself constitutes the teaching of this prior art. However, that teaching does not include the features and elements and aspects of the invention as set forth above. The prior art does not teach modifying the primary reference in a manner suggested by the Examiner, other than through the use of hindsight gleaned from the instant disclosure. Accordingly, it is respectfully submitted that the claims of record clearly define over the prior art.

In view of the foregoing, the Examiner is respectfully requested to reconsider the application, allow the claims as amended and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on June 12, 2003

Max Moskowitz
Name of applicant, assignee or Registered Representative

Signature

June 12, 2003
Date of Signature

Respectfully submitted,

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APPENDIX B

VERSION WITH MARKINGS TO SHOW CHANGES MADE
37 C.F.R. § 1.121(b)(iii) AND (c)(ii)

CLAIMS (with indication of amended or new):

1. (AMENDED) A method for fabricating a high density ceramic thick film comprising the steps of:

preparing a paste by mixing ceramic powders with a [providing] vehicle comprising an organic binder and solvent;

[dispersing ceramic powders into the vehicle to be a paste;]

forming a [the paste to thick] film on a substrate using the paste by screen printing;

removing the organic binder from the film;

applying sol [or sol-like solution] to the surface of the film so that the sol [or sol-like solution] can infiltrate into the film[, the sol-like solution being a material that can be processed as a solution by a sol-gel process;

removing the remaining sol or sol-like solution from the surface of the film by spinning the film];

drying and preheating the film; and

sintering the film at the range from [700] 750 to [1200] 900°C.

3. (AMENDED) The method of claim 1, wherein the sol [or sol-like solution are] has [identical] components identical with the ceramic powder.

4. (AMENDED) The method of claim 1, wherein the sol [or sol-like solution are] has components not identical [components] with the ceramic powder.

5. (AMENDED) The method of claim 1, wherein the sol is applied [thick film is densified by forming a thick film with a certain thickness by screen printing, then having the sol and sol-like solution infiltrated into the surface of the thick film and performing the process] repeatedly more than twice.

8. (AMENDED) A method for fabricating a high density ceramic thick film comprising the steps of:

preparing a paste by mixing ceramic powders with a [providing] vehicle comprising an organic binder and solvent;

[dispersing ceramic powders into the vehicle to be paste;]

forming a [the paste to thick] film on a substrate using the paste by screen printing;

removing the organic binder from the film;

sintering the film at temperatures within the range of 750 to 900°C;

applying sol [or sol-like solution] to the surface of the film so that the sol [or sol-like solution] can infiltrate into the film; and

sintering the film at a temperature within the range from 600 to 700°C.